TÜV Rheinland Group

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Operational Issues

"Method to qualify carry-on child restraint systems intended for use in aircraft and practical application"

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Part I: Martin Sperber, "Method to qualify carry-on child restraint systems intended for use in aircraft"

The number of children up to an age of approx. 12 years accompanying adults in aircraft has continuously risen during the past years. This is especially true for charter flights (holiday carriers).

In its World Air Transport Statistics No. 43 (6/99), the IATA assumes that in regular scheduled traffic (top 50 airlines), the number of children up to 12 years accounts for approx. 2.4%, with the number of children up to 2 years alone accounting for 0.7%. It can be assumed that for charter flights, the share of children is three to four times the number in comparison. According to a leading German charter company, up to 60 children in a Boeing 757 during holiday periods are nothing unusual. This corresponds to a share of more than 10% of accompanying children.

The present situation concerning the transport of children in aircraft in Europe is as follows, whereas there might be slight differences within the single Member States:

Infants under 2 years cannot claim a seat of their own (double occupation adult/infant).
Children older than 2 years are placed in seats for adults. These seats are designed for the needs of adults concerning measurements/dimensions, comfort and means of protection in case of an accident.

Aircraft seats and their restraint systems, normally a pelvic belt, are designed to leave room for occupants whose anatomical characteristics are between a 2-year-old child and an adult, with the restraint systems being intended to be designed to correctly secure the group of occupants described above.

The regulations of JAR-OPS 1.320 and 1.730 govern the transport of infants and children only to an insufficient extent and do not offer any safety at all or scarcely any safety in the case of an aircraft crash, with JAR-OPS 1.320 leaving it open whether the infant should be seated on the adult's lap and be secured by means of a loop belt or any other child restraint system (CRS), without giving any closer description. This insufficient regulatory situation also leads to a different implementation among the JAA Member States concerning the securing of infants and children in aircraft.

With the present, regularly used securing of infants on an adult's lap with a loop belt, the infant's death in case of a crash can be taken for granted. This was the definite result of tests carried out by TÜV Rheinland and the FAA. Due to the "jack-knife" effect of the passenger,

appearing in the event of strong deceleration, the child seated on the adult's lap has, from a technical point of view, the effect of an energy-absorbing element on the adult. The wedging between the adult and the child as the result of the jack-knife effect causes very severe or even fatal injuries of the child. Even without the injuries caused by the wedging, the loads caused by the strap of the loop belt acting on the abdomen (soft parts) and on the not yet fully developed bone structure of the infant's pelvis would be too strong.

Also the transport of children up to an age of approx. 6 years in a seat of their own secured only with the standard pelvic belt does not provide sufficient protection for this age group.

The principle of equality concerning safety applies to all occupants of an aircraft cabin. The aim of all efforts is to close the gap between adults' and children's safety.
The equivalent passive safety for infants and children in comparison to an adult can only be achieved by means of an extra seat for children in combination with a suitable child restraint system. In this context, the protection criteria for adults may not be applied unchanged to infants and children, but have to be replaced by considerations and measures focussing on the needs of children.

Suitable child restraint systems in aircraft are not in use since there has been a lack of explicit requirements for child restraint systems in aircraft in Europe for far.

Detailed research by TÜV Rheinland revealed that child restraint systems taken from the automotive sector may be used in aircraft, thus taking account of the aviation-specific requirements and operational aspects. In order to ensure a safe restraint in a crash by means of a CRS, however, a co-ordinated interaction between the CRS and the aircraft seat, including the means of attachment of the CRS to the seat, is of major importance.
Experience from the US with car CRS approved for the use in aircraft and brought by the parents has shown that an exclusive examination of the CRS, without taking account of the airline-specific configuration of the seats and the attachment of the CRS to the seat, leads to the fact that only approx. 10% of the thus "approved" CRS fitted in the seat and could be fastened safely. The remaining almost 90% of the seats brought along which had been FAA approved CRS could not be used. While boarding this led to discussions between parents and the cabin crew up to disputes, violence and thus resulting delays in the takeoff.

By order of the Bundesministerium für Verkehr, Bau und Wohnungswesen [German Ministry of Transport, Building and Housing] and in close co-operation with the Luftfahrt-Bundesamt [German Aviation Authority], TÜV Rheinland developed the "Qualification Procedure for Child Restraint Systems (CRS) intended for Use in Aircraft" based on the results of two research projects. This procedure does not only lay down the requirements for the CRS itself but also takes account of the seat configuration and the operational aspects of the airline company. This comprehensive reflection ensures that CRS qualified according to this standard do really fit to the provided aircraft seats, can be safely attached and thus provide a safety equivalent to adults' safety.

The Qualification Procedure includes:

- Minimum requirements for child restraint systems
- Specifications of individual seat configurations in the aircraft of airline companies
- Qualification procedures
- Aviation-specific instructions of installation and use
- Marking of qualified CRS
- Marking of aircraft seats in the cabin layout intended for use of qualified CRS

In the meantime, the practical applicability of the procedure has been proved in co-operation with the Luftfahrt-Bundesamt. The LBA informed all German airline companies in a circular of 3 September 2002 that with this procedure the possibility is provided, for the time being voluntarily, to qualify child restraint systems for use in the aircraft of the respective airline company. The thus qualified and marked CRS are taken as "acknowledged by the Luftfahrt-Bundesamt in compliance with Sect. 9, para. 3 of the 5th DVLuftBO". This national procedure has in the meantime been introduced as German contribution to the discussion of the respective JAA Working Group and is regarded as a possibility to transport children in aircraft more safely in the future.

Based on its professional competence and neutrality, TÜV Rheinland was appointed by the Luftfahrt-Bundesamt as competent Qualifying Organisation for the qualification of CRS intended for use in aircraft. On the basis of the qualification procedure, all German and European airline companies are thus immediately able to qualify their CRS for use in their aircraft.

So far, seven airlines have decided to apply this qualification procedure and to qualify automobile child restraint systems for their fleets in accordance with the above procedures. These airlines are:

- **AtlasJet:** Turkish airliner, two different automobile child restraint systems for the weight groups of 0 – 9 kg and 9 – 25 kg
- **LTU:** German holiday carrier, two different automobile child restraint systems for the weight groups of 0 – 9 kg and 9 – 25 kg
- **Condor Flugdienst:** German holiday carrier, four different automobile child restraint systems for the weight groups of 0 – 9 kg and 9 – 25 kg
- **Condor Berlin:** German holiday carrier, four different automobile child restraint systems for the weight groups of 0 – 9 kg and 9 – 25 kg
- **Lufthansa German Airlines:** German airliner, four different automobile child restraint systems for the weight groups of 0 – 9 kg and 9 – 25 kg
- **Lufthansa CityLine:** German airliner, four different automobile child restraint systems for the weight groups of 0 – 9 kg and 9 – 25 kg
- **Air Berlin:** German holiday carrier, four different automobile child restraint systems for the weight groups of 0 – 9 kg and 9 – 25 kg

The qualification has been completed for the following airlines:

- **AtlasJet:** Turkish airliner, two different automobile child restraint systems for the weight groups of 0 – 9 kg and 9 – 25 kg
- **LTU:** German holiday carrier, two different automobile child restraint systems for the weight groups of 0 – 9 kg and 9 – 25 kg
- **Condor Flugdienst:** German holiday carrier, four different automobile child restraint systems for the weight groups of 0 – 9 kg and 9 – 25 kg
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For further information about child restraint systems and their use by the respective airlines please visit www.tuv.com: Click the "TUVdotCOM" button on the lower left, now enter the search term "CRS" (Child Restraint System) in the upper left corner of the page now appearing. The search result lists all airlines which have qualified automobile child restraint systems for their fleets as well as all presently qualified automobile child restraint systems intended for use in aircraft. Below the airlines, you can proceed up to the seat maps marking the seats for the respective aircraft in which the qualified child restraint systems can be used.

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